Summary

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Introduction

This Final Environmental Impact Statement (FEIS) evaluates environmental impacts of Glacier Northwest's application to expand mining at their Maury Island site.

The FEIS contains no decisions or recommendations. Rather, it informs the decision-maker and the public of significant impacts and alternatives, including mitigation measures and alternatives that could achieve the project's objectives but at a lower environmental cost.

Under substantive authority of the State Environmental Policy Act (SEPA) [Washington Administrative Code (WAC) 197-11-660], adverse impacts identified in this FEIS may be used as a basis to condition the project, and significant adverse impacts that cannot be mitigated could be used as a basis to deny the project.

This FEIS revises and replaces the Draft Environmental Impact Statement (DEIS). Changes from the DEIS are in response to public comments, as required under WAC 197-11-560. This FEIS responds to opposing views on significant adverse environmental impacts and reasonable alternatives that King County determined were not adequately discussed in the DEIS.

King County Action Being Considered

King County Department of Development and Environmental Services (DDES) must decide whether to deny, approve, or approve with conditions a grading permit. A Shoreline Substantial Development Permit (SSDP) will also be required by King County.

Key SEPA Milestones Completed

The following list identifies the SEPA steps that have led to the issuance of this FEIS.

- Determination of Significance: August 11, 1998
- SSDP Determination: July 1999
- DEIS Issued: July 1999
- Public Meeting: September 1999
- Commenting on DEIS (extended 60-day Comment Period): July 21 through September 20, 1999.

Major Changes Between the DEIS and FEIS

Most major changes between the Draft and Final Environmental Impact Statement (EIS) focus on terrestrial and marine environments (Chapters 5 and 6). Both chapters have been extensively revised and expanded.

In addition, several potential mitigation measures have been added to protect sensitive species, shorelines, and madrone forest, including:

- retaining 74 percent of the madrone bluff forest area;
- retaining 33 percent of the upland (non-bluff) madrone forest in buffers and as habitat for the pileated woodpecker;
- restoring madrone prior to moving to new mining areas; specifically, maintaining at least 40 percent of the site in madrone at any one time;
- establishing minimum standards for madrone restoration in a mitigation and monitoring plan;
- altering the mining sequence so that already disturbed areas are mined first, thereby allowing areas where madrone has already been impacted to be restored first;
- replacing the existing dock with a new structure to reduce impacts on the marine environment;
- improving shoreline habitat disturbed by previous mining; and
- setting aside a 36-acre stand of mature forest as habitat for the pileated woodpecker, band-tailed pigeon, and other species that use this area; this stand would not be mined until suitable replacement habitat had been established.

These and many other measures will be considered by the decision-maker when deciding whether to approve, approve with conditions, or deny the proposed mining plan.

Proposal Objectives

The Applicant's objectives are:

- to provide prompt and economical delivery of minerals to many customers;
- to be able to respond quickly to large projects for a variety of clients—the "third-runway" project is by far the largest project in the near future, and the Applicant clearly desires to sell product from the Maury Island site to the Port of Seattle for the proposed SeaTac airport third runway;
- to develop a long-term, productive, and profitable site to provide structural fills and other products related to sand and gravel; and
- to maximize mineral extraction, consistent with legal requirements for environmental protection.

The project is a private project, so the project objectives are those of the Applicant, and not King County. The sole objectives of King County DDES are to:

1. comply with SEPA;
2. adhere to its legal responsibilities to ensure a fair and reasoned decision regarding the Applicant's proposal; and
3. implement the DDES mission "to serve, educate and protect our community through the implementation of King County's development and environmental regulations."

To meet these objectives, DDES has prepared this EIS and will consider the environmental impacts of the project, as well as reasonable alternatives that could feasibly attain or approximate the Applicant's objectives, but at a lower environmental cost or decreased level of environmental degradation. These considerations will be factored into the decision, according to King County's substantive authority under SEPA (WAC 197-11-660).

Summary of Proposal and Alternatives

This FEIS analyzes the Applicant's Proposed Action, two additional alternatives that include mining with reduced hours of barging, and the No-Action Alternative. In addition, the FEIS includes more than 75 mitigation measures that are a form of alternative. These measures are ways that could reasonably attain or approximate the proposals objectives, but at a lower environmental cost. Each of these alternatives is described below. Features of the alternatives are summarized in Table S-1 at the end of this chapter.

Description of the Proposed Action

Scale of Operation

Under the Proposed Action, sand and gravel extraction could approach 7.5 million tons (5.5 million cubic yards) per year, with essentially all of the increased material being sent to off-island markets via barge.

When demand for sand is low, the level of operation at the site would also be low. It is likely that the site would be idle for periods of time, depending on market demand.

It follows that the overall life span of the mine would depend on market conditions and the number of large sand and gravel contracts secured by the Applicant. At full production, the site deposits could be mined out in 11 years. Of course, the lower the level of production, the longer the operation could last. The analysis in this EIS assumes a 35-year operating window before the site is closed.

As under current practices, operations would also provide materials for the local market (Maury Island and Vashon Island). The amount of sand and gravel extracted for the local market was estimated to average approximately 15,000 tons in 1998 (range of 10,000 to 20,000 tons per year), with an annual increase assumed to be 2.5 percent for the FEIS analysis; actual increases would depend on market needs and local growth. Local supplies would be delivered by truck, at a rate not to exceed 20 trucks per day.

Clearing and Ground Preparation

Clearing of the site would be phased with mining activities. Clearing would occur in scheduled phases of approximately

32 acres each. No more than two phases, or 64 acres of mining/reclamation activities, would be in process at any one time.

To address public safety concerns regarding arsenic contamination of site soils, the Applicant is proposing to fully contain contaminated materials at the site within a sealed berm. No contaminated materials would be removed from the site. At full capacity (when mining is complete), the berm would measure up to 30 feet high and 2,100 feet long. The berm would be located on the northern edge of the site, but outside of the 50-foot vegetated buffer (see next paragraph), which would be maintained.

Maintenance of the 200-foot shoreline buffer and a 50-foot buffer between the site and neighboring properties would result in approximately 14 percent of the site being retained as open space and upland habitat.

Table S-1 outlines other major features of the Proposed Action.

Alternative 1- Reduced Barging Hours, Scenario 1

Alternative 1 differs from the Proposed Action in that barge loading would be restricted to 16 hours each weekday and 9 hours on Saturday (Monday – Friday 6 a.m. to 10 p.m., Saturday 9 a.m. to 6 p.m.). This alternative was developed by the EIS Team in response to public comments and is intended to allow the Applicant, the public, and decision-makers at King County to compare the environmental impacts of the Proposed Action to this hypothetical scenario of reduced hours for barge loading.

Table S-1 compares other features of this alternative with the Proposed Action.

Alternative 2 - Reduced Barging Hours, Scenario 2

Under Alternative 2, barge loading would be restricted to 12 hours each weekday and on Saturday (Monday – Saturday 7 a.m. to 7 p.m.). As with Alternative 1, Alternative 2 would reduce the ability of the Applicant to provide sand and gravel products on demand, and, therefore, does not meet the project objectives as well as the Proposed Action.

Table S-1 compares other features of this alternative with the Proposed Action.

No-Action Alternative

Under SEPA, King County must evaluate the "No-Action Alternative", which is defined by the state SEPA Handbook as "what would be most likely to happen if the proposal did not occur".

For the purpose of comparative analysis and to understand the environmental effects of the Applicant's proposal, this EIS considers the No-Action Alternative as the status quo, or essentially how the mine has operated on average over the past 20 years, with no barging and a very low level of mining for the local market only.

The features of the No-Action Alternative are summarized and compared to the Proposed Action in Table S-1.

Mitigation Alternatives

One of the primary functions of an EIS is to inform decision-makers and the public of reasonable alternatives, including mitigation measures, that would avoid or minimize adverse impacts or enhance environmental quality (WAC 197-11-400).

This EIS includes more than 75 mitigation measures. Each measure is based on policies, plans, rules, or regulations formally designated by King County (or appropriate legislative body) and in effect when the DEIS was issued.

Each mitigation measure listed in the EIS (1) relates to a specific, adverse environmental impact identified in the EIS and (2) has been determined by King County to be reasonable and capable of being accomplished. To be reasonable, mitigation must be in proportion to the impact.

Responsibility for implementing mitigation measures may be imposed upon an Applicant only to the extent that the identified adverse impact is attributable to the proposal.

Madrone Reclamation Alternative (evaluated in Chapter 5)

Mining would require the eventual clearing of one of the largest madrone stands in Washington. While not protected by any specific law, madrone forests are becoming increasingly rare, are valued by the community, and support wildlife habitat, including habitat for band-tailed pigeons, a species that receives some protection under King County policy.

Therefore, this EIS includes mitigation measures to restore madrone forest (see Chapter 5). The greatest hindrance this may pose for the operator of the site is that they could not mine out the site in 11 years (as could occur under maximum production), but instead would have to allow restoration to occur on mined areas before completing the later stages of mining.

Pileated Woodpecker Habitat Retention Alternative (evaluated in Chapter 5)

King County Policy NE-604, Policy NE-603 states that:

In the Rural Area and Natural Resource Lands, habitats for "candidate" priority species … shall not be reduced and should be preserved.

Pileated woodpecker is the only terrestrial species designated under Policy NE-603 that is present on the site. Pileated woodpeckers most often nest in large Douglas-fir trees that are diseased or recently dead but still standing. About a dozen such trees are present in a 42-acre stand of mixed madrone/Douglas-fir forest on the northeastern portion of the site, which can therefore be considered typical habitat.

Placing some or all of a 36-acre stand of mixed Douglas-fir and madrone as a permanent set-aside would maintain the best habitat for pileated woodpeckers on the site. However, this would greatly reduce the amount of minerals available for mining.

Another option that does not so severely impact the project objectives would be to create habitat elsewhere prior to removing the 36-acre patch. Areas could be revegetated with some Douglas-fir and enhanced with created Douglas-fir snags (standing dead trees) relocated from cleared areas. These areas in turn could be set aside as habitat areas for this species.

New Dock Alternative (evaluated in Chapter 6)

As an alternative to simply repairing the exiting dock, the EIS Team developed a plan to replace the existing dock with a new structure. This new structure would (1) allow the use of the latest technology to reduce shade and contamination; and (2) extend the dock to deeper water, thereby avoiding impacts to the most sensitive areas of the shoreline. Dock replacement would also avoid the need for repeated repairs that would be expected if the old structure is maintained.

This alternative has two other options that could be considered. First, the dock could be rebuilt, but not extended. Second, replacement could be limited to the dock "stem," which would eliminate the need for repeated construction close to the beach, but would not provide the other benefits that the two other options provide.

Significant Areas of Controversy and Issues to be Resolved

As required under SEPA (WAC 197-11-408), King County conducted scoping to "narrow the scope of [the] EIS to the probable significant adverse impacts and reasonable alternatives, including mitigation measures." Toward this end, King County invited agencies, affected Tribes, and members of the public to comment on the Determination of Significance (WAC 197-11-360).

The major controversial issues identified during this process include groundwater supplies, visual and noise disturbance, arsenic contamination of topsoils, removal of madrone forest, and potential effects on marine habitat. These issues, and other questions raised during scoping, are listed at the beginning of Chapters 3 through 12 of this EIS in the sections titled "Primary Issues". These issue questions are then addressed in the impact analysis in each chapter.

Environmental Setting

The following factors contribute to the overall environment at the site.

The Island Environment

- The site is on an island, which means that the environment includes elements of both marine and terrestrial systems, as well as increased sensitivity to change.
- The island environment evokes social sensitivities as well, and tends to promote a strong sense of community among residents. This sense of community is an important element of the human environment and quality of life.
- Water is one of the resources on an island that is particularly sensitive. All of Vashon and Maury Islands are classified as a sole-source aquifer and groundwater recharge area.

The Rural Environment

- The area is intrinsically rural in character, involving a mix of built and natural features and process. As can be seen in Figure 1-2, Maury Island is well forested, but also contains clusters of residential development, particularly around Quartermaster Harbor to the south of the site.
- King County has a strong commitment to keep rural areas rural, and to avoid urban sprawl and other uses that conflict with traditional rural uses and values.
- Residents place tremendous value on the rural environment of the island.
- Agriculture, forestry, and mining are part of the rural environment, as are low-density housing, open space, and wildlife habitat.
- The Sandy Shores and Gold Beach subdivisions are suburban density developments that were developed within a rural area (this is due to less stringent environmental requirements in place when the developments were reviewed by King County).
- These suburban density developments flank the shoreline on both sides of the site. These developments alter the visual

character of the area, shoreline processes, and level of concern for conflicts between mining and residential uses. Figure 1-2 illustrates the location of these communities in relation to the project site.

The Shoreline Environment

- Much of the shoreline along Maury Island is bulkheaded. Bulkheads block many of the interactive processes and exchanges that occur between marine and terrestrial environments (see Figure 11-5).

- The site is not bulkheaded, but the shoreline near the dock has been modified by past mining activities. Much of the vegetation has been previously cleared, some of the shoreline is armored by rip-rap (a wall created by large blocks of stone), and the dock itself remains as a built feature.

- Even though intensive mining has taken place at the site (with little consideration of environmental protection), the shoreline contains eelgrass; macroalgae (seaweeds); various substrates; clambeds; threatened salmon; and habitat for other sensitive species, such as rockfish, cod, and lingcod. In addition, herring, sandlance, and surf smelt spawning occurs at the site.

- The dock and sunken barges from past mining create artificial "reef" habitat for species that would otherwise be absent.

- This diversity is evidenced by the fact that recreational divers often visit the site.

Historic Context of Mining

- The site contains an obvious open "pit" from previous mining, and the dock is a major visual feature of the shoreline.

- Mining has been a feature of the environment for many decades and predates much of the residential development.

- The mineral designation of the site has precluded other development, leaving a native madrone forest cover over much of the site.

Forest and Wildlife

- King County recognizes that provision of wildlife habitat is an important functional value of natural resource lands, such as mineral, forestry, and agricultural lands.
- Maury Island contains the largest stands of madrone forest in King County.
- Madrone forest is not formally designated as a sensitive or unique community and no law prohibits its clearing. Nonetheless, it contributes to the county's biodiversity.
- The madrone forest provides wildlife habitat, contributes organic and inorganic materials to the marine environment, stabilizes slopes, and imparts a natural appearance that both contrasts with and softens the built features of the shoreline.
- Shipping and recreational marine traffic are commonplace off the Maury Island shoreline. A major shipping lane lies off Point Roberts, east of the project site.

Arsenic and Other Contaminants

- The topsoils of Maury Island, including those on unmined portions of the site, are contaminated with metals, with arsenic and lead being the primary concern. Concentrations vary widely from place to place, with lower levels typically found in areas that have been disturbed (due to mixing and removal of materials).

Phased Review

No phased review is anticipated.

Summary of Impacts, Mitigation, and Significant Unavoidable Adverse Impacts

Impacts, mitigation measures, and significant unavoidable adverse impacts for each of the alternatives are summarized in Table S-2.

Overview of Key Impacts

Within the context of the site being zoned mining, the many project impacts are the types that would be expected: changes in views, noise to surrounding communities, and clearing of forest and associated loss of wildlife habitat.

The main conclusion presented in Chapters 3 through 12 is that sufficient mitigation is available to effectively mitigate the major project issues of marine habitat, salmon, groundwater, arsenic, madrone forest, and wildlife.

Two facts are critical to understanding this conclusion. First, mitigation plays a major role in avoiding significant impacts. Second, under SEPA, an impact can be sufficiently mitigated, while remaining adverse. In other words, mitigation need not totally eliminate an impact, but merely needs to reduce it to an acceptable level.

The project, as proposed, would probably result in significant adverse impacts. This EIS identifies these and includes alternatives and compensatory measures that (a) are technically and economically feasible; (b) would adequately mitigate the impact to comply with established plans, policies, and laws; and (c) would still allow the Applicant to reasonably meet its project objectives.

Even with mitigation, the project would result in several undesirable impacts. The project would greatly change the overall character of the site, and the project would be visible and audible from many places. The site is zoned for mining and noise levels and other effects would be within King County Code limits. Thus, there is insufficient evidence to justify these impacts as "significant."

Removal of mineral resources from the site would result in irreversible and irretrievable commitments of natural resources. These commitments are not likely to harm long-term environmental productivity. Analysis showed no indications that mining of the site would harm the long-term environmental productivity and use of the site, including groundwater recharge and availability, wildlife and fish habitat, or opportunities for long-term subsequent use of the site.

Finally, the project would result in some adverse effects to Puget Sound chinook salmon and their habitat, as well as other features of the marine environment. The extent of these impacts would be

limited to the site, and many mitigation measures are available. These measures were developed in consultation with technical experts from the Washington Department of Fish and Wildlife (WDFW), the Washington Department of Natural Resources (WDNR), and King County. We expect that mitigation will be further defined by the WDFW, WDNR, U.S. Army Corps of Engineers, and National Marine Fisheries Service, under their regulatory authority.

Evaluation of Impacts Based on SEPA Criteria

WAC 197-11-330, which outlines the process under which threshold determinations of significant impacts are made, provides the clearest criteria for determining whether or not an impact is "significant" under SEPA:

(a) A project may, to a significant degree: Adversely affect environmentally sensitive or special areas, such as loss or destruction of historic, scientific, and cultural resources, parks, prime farmlands, wetlands, wild and scenic rivers, or wilderness.

The site contains three types of environmentally sensitive or special area: (1) shoreline and marine environment associated with the dock; (2) madrone forest; and (3) the sole-source aquifer. The Applicant's project objectives, with additional mitigation, could be reasonably obtained with no net loss of these special areas. "No net loss" means that adverse impacts may occur, but that they could be sufficiently mitigated.

For the marine environment, dock construction would disturb marine sediments and operations would shade and produce noise and vibration that may cause fish to avoid the area. These impacts would be limited to the site of action and could be mitigated through several conditions, including revised performance standards for the dock and replacement and/or enhancement of marine habitat near the site. The independently conducted marine assessment by the Washington Department of Ecology (Ecology) supported this conclusion.

For madrone forest, madrone could be effectively reestablished at the site, as demonstrated by the natural regeneration documented in previously mined areas. The areas are not expected to come back exactly as they are now, but, being a species associated with disturbance, madrone would probably come back to sufficient densities to replace most of the values currently being provided.

For the sole-source aquifer, groundwater intrusion could be avoided through known and standard mining practices, so that contamination and/or aquifer breach would be highly unlikely. There is no evidence to support claims that the project would significantly reduce aquifer recharge. The independently conducted Ecology study supported this conclusion.

While the project may adversely affect Puget Sound chinook salmon (a threatened species) and its habitat, this impact could be effectively mitigated through habitat enhancement and timing to avoid disturbance.

The evidence shows that the Applicant's project objectives could be reasonably obtained while meeting the requirements of the many laws applicable to the proposal. Of course, decisions of other governmental agencies with jurisdiction cannot be fully predicted.

As is typical for SEPA EISs this FEIS has been issued prior to final approval under other applicable laws. This is because SEPA (WAC 197-11-055) encourages EISs to be prepared for private proposals at the conceptual stage rather than the final detailed design stage. Most applicable state and federal laws require design-level analysis, which is not required under SEPA.

Issuance of a revised grading permit would not establish a precedent for future actions with significant effects.

The analysis indicates neither unique nor unknown risks to the environment nor risks to public health or safety. Risks and impacts related to arsenic and groundwater can be avoided by proven technologies.

Table S-1. Comparison of Features among Alternatives

Component	*No-Action Alternative*	*Proposed Action*	*Alternative 1*	*Alternative 2*	*Proposed Action with all Additional Mitigation (including restricted hours)*
SCALE OF OPERATION					
Area to be Mined	Ultimately, 193 acres, but much smaller area within the foreseeable future	193 acres	Same as Proposed Action	Same as Proposed Action	174 acres
Estimated Maximum Annual Extraction	20,000 tons	7.5 million tons*	5.72 million tons*	3.12 million tons*	3.12 million tons*
Duration of Project	Mining to occur indefinitely	Between 11 and 50 years. Assumed to be 35 years for analysis in the EIS	Between 15 and 60 years. Assumed to be 40 years for analysis in the EIS	Between 30 and 75 years. Assumed to be 50 years for analysis in the EIS	Between 25 and 70 years
Local Market Sales	Local market sales would average 15,000 tons annually (range 10,000 to 20,000 tons per year) of sand and gravel, with an annual assumed increase of 2.5%	Same as No-Action	Same as No-Action	Same as No-Action	Same as No-Action
Trucking	Average hauling less than 5 trucks/day, over a 6-day week, assumed to increase at 2.5% annually, with a maximum of 20 trucks/ day each way (40 one-way trips)	Same as No-Action	Same as No-Action	Same as No-Action	Same as No-Action

Table S-1. Continued

Component	*No-Action Alternative*	*Proposed Action*	*Alternative 1*	*Alternative 2*	*Proposed Action with all Additional Mitigation (including restricted hours)*
Hours of Active Mining	Current hours of mining: M-F 7 a.m. – 7 p.m. Sat 9 a.m. – 6 p.m. Maintenance could occur at any time	M-F 6 a.m. – 10 p.m. Sat 9 a.m. – 6 p.m. Maintenance could occur at any time	M-F 6 a.m. – 10 p.m. Sat 9 a.m. – 6 p.m. Maintenance could occur at any time	M-F 7 a.m. – 7 p.m. Sat 9 a.m. – 6 p.m. Maintenance could occur at any time	M-F 7 a.m. – 7 p.m. Sat 9 a.m. – 6 p.m. Maintenance could occur at any time
Hours Barge Loading would be Allowed	None	No restrictions	16 hours per weekday, 9 hours on Saturday: M-F 6 a.m. – 10 p.m. Sat 9 a.m. – 6 p.m.	12 hours per day, M-Sat 7 a.m. – 7 p.m.	12 hours per day, M-Sat 7 a.m. – 7 p.m.
Barging	None	Maximum of four 10,000-ton barges loaded in each 24-hour period (or a greater number of smaller barges)	Maximum of two 10,000-ton barges loaded in each weekday and one on Saturday (or a greater number of smaller barges)	Maximum of one 10,000-ton barge loaded in each working day (or a greater number of smaller barges)	Maximum of one 10,000-ton barge loaded in each working day (or a greater number of smaller barges)
Employment	5 staff or fewer would operate the site	2 to 20 staff would operate the site at any one time, with two shifts for mining and three shifts for barge loading	2 to 18 staff would operate the site at any one time, with two shifts for mining and for barge loading	2 to 12 staff would operate the site at any one time, with one shift for mining and for barge loading	2 to 12 staff would operate the site at any one time, with one shift for mining and for barge loading
Clearing and Ground Preparation	Conducted in slow progression from the central portion of the site out	Phased clearing, with two areas up to 32 acres being cleared and prepared for mining at any one time. Up to 64 acres of land being mined or actively reclaimed at any one time	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action

Table S-1. Continued

Component	*No-Action Alternative*	*Proposed Action*	*Alternative 1*	*Alternative 2*	*Proposed Action with all Additional Mitigation (including restricted hours)*
FACILITIES AND EQUIPMENT					
Structures	None	Small office, storage and security areas, and portable restroom. Repairs to dock structure	Same as Proposed Action	Same as Proposed Action	Old dock replaced with extended, state-of-the-art facility
Access and Roads	Use existing	Same as No-Action, but additional access roads constructed as mining progresses	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Heavy Equipment	Wheel loaders used to load trucks	Combination of bulldozers and wheel loaders used for barge-based projects	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Processing Equipment	Portable screening plant as needed (expected on site for about 1 month every 5 to 10 years)	Portable crushing and screening plant as needed (expected on site for 1 to 2 months once every 3 to 4 years)	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Conveyance Equipment	Material loaded onto trucks for on-island deliveries	Truck loading for on-island deliveries. Material for off-island deliveries would be transported from mined areas to barges using a conveyer belt system, ranging in length from 1,200 to 3,400 feet	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action

Table S-1. Continued

Component	*No-Action Alternative*	*Proposed Action*	*Alternative 1*	*Alternative 2*	*Proposed Action with all Additional Mitigation (including restricted hours)*
RECLAMATION	Low levels of mining would require little reclamation. Most reclamation done in small patches to minimal standards (as required by WDNR permit). Little or no terracing for several decades	Active mining/reclamation confined to 64 acres at one time, up to two 32-acre phases. Reclamation would follow WDNR guidelines and may include use of native plants and habitat features for wildlife. Topsoil would be manufactured onsite and augmented with offsite materials as necessary to meet WDNR reclamation standards	Same as Proposed Action	Same as Proposed Action	Major emphasis on restoring madrone forest
BUFFERS					
Adjacent Property Buffers	50-foot vegetated buffers around perimeter of site	Same as No-Action	Same as No-Action	Same as No-Action	Same as No-Action
Shoreline Buffer	200-foot shoreline buffer from ordinary high water mark of Puget Sound	Same as No-Action	Same as No-Action	Same as No-Action	Same as No-Action, also restore shoreline habitat
Stormwater Management	No stormwater pond constructed	A new stormwater pond would be constructed	Same as Proposed Action	Same as Proposed Action	Dispersed stormwater system, rather than centralized pond
* Numbers approximate.					

Table S-2. Summary of Adverse Impacts

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Chapter 3 – Air Quality			
Air Impact 1. Potential visible dust leaving the site when the operation is near the site edges. Possible insufficient inspection staff.	1. Require air quality monitoring and reporting.	Identify and remediate problems early.	Conceivably occasional minor and temporary violations (e.g., a dust cloud leaving the site in a high wind).
Chapter 4 – Geology and Hydrogeology			
Geo/Hydro Impact 1. Altered recharge and drainage regime.	1. Revise the mining plan by replacing the applicant-proposed pond with a multiple-point and upslope drainage plan.	Reduced alteration of recharge and drainage regime by more closely mimicking the existing infiltration plan onsite.	1. Constructed drainage would cause some minor concentrations in recharge (i.e., more at collection points).
Geo/Hydro Impact 2. Greater peaks and lows in water table and potential intrusion into groundwater.	2. Require direct measurement of groundwater as mining approaches final grade. Establish minimum 25-foot separation between mining and existing groundwater level.	Reduce the likelihood of aquifer intrusion.	2. Localized peaks and troughs in the water table, but not sufficient to have any noticeable effect on wells.
Geo/Hydro Impact 3. Increased water use.	3. Implement water conservation measures and consumption monitoring/reporting. Alternatives to using local water supply could be implemented.	Minimize water consumption.	3. Dust control would require water consumption.
Geo/Hydro Impact 4. Spillage of fuel, oils, and liquids during equipment and vehicle refueling and maintenance.	4. Create a designated fuel area to contain possible fuel spills.	Reduce the likelihood of pollutant spill, protecting water quality.	None.
Geo/Hydro Impact 5. Potentially unstable slopes could increase potential for landsliding.	5. Perform slope stability calculations in developing final mine contouring and reclamation design.	Reduce the threat of slope failure and landsliding.	None.

Table S-2. Continued

Specific Adverse Environmental Impacts	*Possible Mitigation*	*Intended Environmental Benefits*	*Unavoidable Adverse Impacts*
Chapter 5 – Terrestrial Plants and Animals			
Terrestrial Impact 1. Long-term loss of madrone forest.	1a. Revegetate completed phases with madrone forest, rather than Douglas fir or hydroseeding.	Maintains madrone forest on the site and ensures restoration efforts. Reduces impacts on views and wildlife habitat (e.g., band-tailed pigeon).	With additional management and adjustments to the applicant's mining and reclamation, madrone forest should remain the dominant cover on the project site indefinitely, although the forest would take 50 years or more to mature and may never fully recover to preproject conditions. Direct clearing of vegetation and long-term regrowth following mining cannot be avoided. Madrone forests could be replaced, although it would take several decades to approximate current conditions.
	1b. Prohibit hydroseeding except where necessary to control erosion and use only native seed mixes.	Increases native vegetation cover.	
	1c. Submit a Revegetation and Monitoring Plan for King County review and approval, and implement the plan.	Provides necessary details for permitting and design stage, assures effectiveness of reclamation plan and accountability for its implementation, and allows for corrective adaptation.	
	1d. Monitor restoration to ensure that performance standards are being met.	Ensures compliance with performance standards.	
	1e. Implement efficient monitoring and County review so as not to cause unnecessary delays that would unduly hinder project objectives (e.g., revegetation targets could be defined as part of the periodic review required for mining sites per KCC 21A.22.050).	Increases project efficiency, which ultimately increases speed with which mitigation efforts are implemented.	

Table S-2. Continued

Specific Adverse Environmental Impacts	*Possible Mitigation*	*Intended Environmental Benefits*	*Unavoidable Adverse Impacts*
	1f. Since mining would occur in phases, plan, implement, and monitor reclamation in phases (including both interim and final reclamation).	Consistent implementation of reclamation measures throughout the duration of the project.	
	1g. Control Scot's broom and Himalayan blackberry to prevent them from invading cleared areas.	Prevents spread of invasive species and encourages maintenance of native vegetative cover.	
	1h. Alter phased mining sequence so that highly disturbed shrubland ecosystems are mined early in the process, thus releasing these areas for revegetation to begin. Where possible, phase mining so that mining crosses each area only once. Where not possible, limit interim site stabilization measure to erosion control.	Hastens restoration efforts in highly disturbed shrubland ecosystems. Improves ecosystem recovery due to limited repetition of disturbance. Increases the amount of madrone forest on the site at any one time.	
	1i. Create gentle undulations and mounds up to a few feet high to improve colonization and survivability of madrone seedlings.	Improves success of madrone restoration on the mine floor.	
	1j. Establish minimum number of acres that must be maintained as madrone forest at any one time, using the specific performance standards developed in the Revegetation and Monitoring plan.	Prevents major time lag between impacts and mitigation.	
	1k. Do not cut trees within buffer areas except in rare cases for hazard tree removal. Prune newly exposed Douglas-fir trees that provide important screening to reduce "sail" and associated vulnerability to blowdown.	Provides long-term protection of forested buffers, along with associated visual screening and dust control benefits.	Some increased blowdown of newly exposed Douglas-fir would be expected.

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
	1l. Increase buffer where practical based on existing topography and mining needs. Alternatively, increase standard buffer from 50 to 100 feet.	Reduces vulnerability of buffer forest trees to death and disease.	
	1m. In buffer areas dominated by Himalayan blackberry, Scot's broom, or herbaceous weeds, remove vegetation and replant with native trees and shrubs characteristic of madrone forest.	Reduces populations of invasive species and promotes increased coverage by native species. Provides long-term protection of forested buffers, along with associated visual screening and dust control benefits.	
Terrestrial Impact 2. Loss of up to 139 acres of band-tailed pigeon habitat.	2a. Retain a greater portion of the bluff, as described in Chapter 11 (Figure 11-8), to maintain an additional 9 acres of existing madrone forest. Retention of some or all of the mature madrone/Douglas-fir forest patch (Terrestrial Mitigation 3) would retain up to 36 additional acres.	Reduce habitat loss for band-tailed pigeons.	Band-tailed pigeon habitat would be reduced for several decades as mature madrone forest is removed. Restored areas have the potential to provide habitat within as little as 5 years, but would most likely require at least 20 years to provide good habitat.
	2b. Restore madrone on reclaimed areas to gradually replace lost band-tailed pigeon habitat (per Terrestrial Mitigation 1). Madrone begin producing berries within 5 years.		

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Terrestrial Impact 3. Loss of habitat for pileated woodpecker.	3. Prior to clearing, conduct additional surveys to document actual pilieated woodpecker use of the 36-acre stand of mature mixed Douglas-fir forest on the northern part of the site. Set aside this area if used regularly for foraging and/or if used for nesting. Alternatively, establish habitat by planting Douglas-fir and placing snags on mined areas. Do not impact the existing 36 acres until replacement habitat is established.	Maintain habitat for pileated woodpeckers.	None. With placement of snags, pileated habitat could be preserved onsite.
Terrestrial Impact 4. Reduction in habitat meeting "Fish and Wildlife Habitat Conservation Area" criteria.	4. Install a bald eagle perch pole along the shoreline. Also, protecting more of the bluff (per Chapter 11) and shoreline enhancement (per Chapter 11) would greatly offset this impact.	Increase hunting habitat for bald eagles. Appropriate perch trees are a limiting factor in bald eagle habitat.	Noise, activity, and forest clearing would cause unavoidable reductions in wildlife habitat, although mitigation measures for madrone forest and marine habitat provide good opportunities to benefit and protect the functioning of the area as fish and wildlife habitat.
Terrestrial Impact 5. Impacts due to herbicide use.	5. Follow King County policies of Integrated Pest Management for public lands.	Offer additional protection to nontargeted plants and animals, as well as to ground water.	None.
Terrestrial Impact 6. Loss of red-tailed hawk foraging and potential nesting habitat.	6. Place perch poles throughout site to improve hunting habitat. Place an artificial nest structure within a buffer area.	Improve habitat for red-tailed hawks.	None.

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Terrestrial Impact 7. Destruction of bird nests and/or eggs.	7. Prohibit vegetation clearing between March 1 and July 15 of any given year.	Protect nesting and breeding wildlife.	Birds and other wildlife would be reduced. Individual animals would leave the site and some may perish. Effects would be limited to individuals on the site and would not significantly affect populations or protected species.
Chapter 6 – Marine Habitat and Fisheries			
Marine Impact 1. Repeated repairs of the dock would disturb marine sediments and inhibit recovery. The existing design creates more shade than more modern designs and materials would cause.	Option 1, element a. Replace the existing dock to meet the latest design and materials standards.	Eliminate the need for repeated disturbance in the nearshore area and allow the area to recover from physical damage. Results in most environmentally sound design and materials, thereby minimizing shading and "footprint."	Significant impacts can be avoided or compensated for. Some disturbance would be unavoidable during construction. The dock would still create shade and physical presence.
Displacement of fish and potential physical disturbance due to the relatively shallow loading area.	Option 1, element a (cont.) Extend dock up to 50 feet.	Protect shallow water, where biological communities are most diverse. Eliminate eelgrass shading from barges.	Significant impacts can be avoided or compensated for. An extended dock would be more visible than the existing dock. Rockfish, cod, and other sensitive species would be reduced or eliminated underneath and near the loading area, even though habitat could be compensated for through enhancement at other areas.
Creosote contamination from existing pilings.	Option 1, element b. Replace creosote pilings with non-contaminating material. Clean up creosote from sediments following removal of pilings.	Remove creosote contamination source from nearshore environment.	Some creosote would be released during piling removal but would quickly disperse.

Table S-2. Continued

Specific Adverse Environmental Impacts	*Possible Mitigation*	*Intended Environmental Benefits*	*Unavoidable Adverse Impacts*
Shading of light-dependent nearshore biota by the dock structure.	Option 1, element c. Construct superstructure to allow as much light as possible to pass through.	Reduce shading associated with the dock.	Some shading is inevitable. Shading from a new design could be substantially less than shading from the existing dock. Shading would affect eelgrass over an area of about a few hundred square feet. This loss could be compensated for by planting eelgrass in other areas.
The dock would introduce physical structure that could interfere with nearshore movement, including fish passage, currents, and sediment transport.	Option 1, element d. Construct the minimum structure necessary for the intended function. Use steel or concrete to reduce the number of pilings needed by about half.	Reduce physical presence and influence of the dock.	Pilings could conceivably interfere with along-shore movements, but the overall affect would be moderate and less than existing conditions.
Sand and gravel would spill and potentially bury marine organisms. (see also Marine Impact 5).	Option 1, element e. Include a spill recovery system.	Reduce volume of potential gravel spillage associated with barge loading.	Some spillage may still occur and lead to changes in the species population structure around the new material.
Prop wash created due to maneuvering barges back and forth along the dock could affect nearshore sediments and organisms. (see also Marine Impact 4).	Option 1, element f. Include a "haul-back system".	Reduce potential propwash associated with barge positioning.	Some propwash could still affect eelgrass. Planting eelgrass in other areas could compensate for impacted areas.
Potential physical disturbance to eelgrass during construction, and subsequent loss due to shading.	Option 1, element g. Prior to construction, identify, measure and mark eelgrass to avoid physical damage.	Avoid unnecessary damage to eelgrass and provide a mechanism to achieve no net loss of eelgrass habitat.	If damage to eelgrass occurs, there would be a lag between eelgrass loss and successful mitigation.
Lighting could affect marine creatures, some adversely some beneficially.	Option 1, element h. Install protective covering to minimize lighting of the water below the dock.	Avoid potential effects of unnatural light source on the behavior of plants and animals near the dock.	Lighting could be effectively reduced through screening.

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Removing piles would create temporary turbidity and sediment disturbance.	Option 1, element i. Use "vibratory extraction" method for pile removal.	Minimize turbidity and sediment disturbance during pile removal.	Some increased turbidity and sediment disturbance would occur but be limited to a relatively short time period and small area of disturbance around the base of the pilings.
Construction and repairs could disturb herring, surf smelt, and sand lance spawning.	Option 1, element j. Time construction and repair activities to avoid periods of herring, surf smelt, and sand lance spawning and salmon migration during any given year, as determined by King County (in consultation with WDFW and WDNR).	Avoid disturbance associated with construction during sensitive life-history phases of species of concern.	Individuals may still be present during construction activities and may temporarily avoid the site, however, direct harm from construction activities is unlikely.
Potential failure to follow mitigation measures on behalf of applicant and/or contractors working on behalf of the applicant.	Option 1, element k. Have independent environmental monitor(s) present during all construction activities.	Provide independent assessment and confirmation of implementation of mitigation measures.	
Marine Impact 1. Physical disturbance of marine sediments by dock repairs and shading and physical impacts related to dock design and location (Section 6.4.3).	Option 2. Same as Option 1, but without extending the dock.	Same as described above.	Impacts due to spilling, shading, and propwash would be greater than under option 1 because loading would occur closer to the sensitive shoreline area.
Marine Impact 1. Physical disturbance of marine sediments during dock repairs and shading and physical impacts related to dock design and location (Section 6.4.3).	Option 3. Replace dock stem.	Reduce shading, creosote contamination, and disturbance due to repairs within the nearshore environment.	Adverse impacts due to creosote, shading, and repairs would be greater than under options 1 and 2.

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Marine Impact 2. Reduction of eelgrass due to shading and/or physical impacts from barges and tugs.	2a. Define and mark as "off-limit" to barges and tugs any sensitive areas, including all area between dolphins and shoreline, and the two shallow shelves, located 300 feet north and 200 feet south of the dock, respectively.	Limit the potential for shading and/or physical damage to current eelgrass beds as well as areas potentially suitable for eelgrass recolonization.	With avoidance, impacts would be moderate at most and potentially negligible. Habitat enhancement would also serve to offset this impact.
	2b. Allow only one barge at the site at one time. Prohibit tugs and barges from tying up or otherwise being present along the dolphins.	Avoid shading and maneuvering impacts in areas away (north or south) from the immediate end of the dock.	The one barge and tug allowed would shade and/or physically impact the area immediately at the end of the dock.
Eelgrass may be lost, although since impacts are not direct, the specific amount of reduction cannot be predicted.	2c. Create an eelgrass mitigation area of approximately 1,000 square feet (a greater area may be specified by WDFW).	Offset uncertainty regarding potential impacts to eelgrass from shading and physical impacts from tugs and barges, including propwash, spillage, and other mechanisms.	A lag time may exist between eelgrass disturbance and successful mitigation.
Potential ineffectiveness of mitigation.	2d. Require mitigation plans to contain information required by WDFW for marine habitat mitigation.	Ensure better success of mitigation through proper design and analysis.	None.
Marine Impact 3. Reduction of marine life due to shading, noise, vibration, and visual disturbance from barges and tugs.	3a. Restrict barge docking to one barge at a time (see Marine Impact 2).	Reduce the amount of shading and maneuvering due to barges at the site.	Loading and barging would create unavoidable noise and disturbance to the area immediately surrounding the dock. Marine life would leave the area and compete with others in occupied habitat. Affected species include sensitive species such as rockfish and lingcod. Creation of reef habitat would compensate for this loss, but the loss would occur nonetheless.

Table S-2. Continued

Specific Adverse Environmental Impacts	*Possible Mitigation*	*Intended Environmental Benefits*	*Unavoidable Adverse Impacts*
	3b. Replace, enhance, or provide substitute resources to compensate for habitat lost due to shading and disturbance. Habitat enhancement might include substrate enhancement, riparian/shoreline enhancement, and/or artificial reef habitat.	Replace habitat potentially degraded by shading and other disturbances from the project. Habitat enhancement should be located as close to the project area as possible.	A lag time may exist between habitat disturbance and completion of successful mitigation.
Marine Impact 4. Propwash scour of benthic sediments reducing or eliminating marine life and damaging eelgrass near the waterward end of dock.	4a. Establish an approach and departure protocol with the following provisions: Prohibit fully loaded 10,000-ton barges to be present at the dock during negative tides (tides lower than MLLW).	Prevent grounding of barges and damage to benthic marine life.	Barging activity would cause propwash scour of the benthic sediments near the waterward end of the dock. Although mitigation measure may serve to reduce this impact, marine life near the end of the dock would be reduced.
Propwash during departure.	4a (cont.) Require tugs to "back" the barge away from the dock.	Place the tug in deeper water away from the shoreline. In addition, propwash is dissipated by the barge which has a deeper draft.	
	4a (cont.) Use a "standing spring line" if weather does not permit "back away" (above).	Allow barges to be maneuvered away from the dock with significantly less thrust than otherwise required.	
Propwash from slowing down and speeding up barges.	4a (cont.) Define and require very slow approach and departure speeds.	Minimize propwash velocity and intensity while tugs and barges are near the dock.	
Propwash from tug propellers being directed toward shore.	4a (cont.) Prohibit tugs from directing propwash toward shore. Define exceptions and maximum throttle limits for those conditions.	Reduce propwash that may potentially disturb nearshore marine life and habitats.	

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Propwash from tug operators not knowing the sensitivity of the nearshore areas.	4a (cont.) Train, test, and certify tug operators in approach and departure protocols. Require annual recertification.	Eliminate impacts due to lack of knowledge or sensitivity among tug operators.	
Propwash from tugs maneuvering barges back and forth underneath the loading area.	4b. Establish a "haul-back" system to eliminate the need to use tugs during loading.	Reduce the need for tugs and associated propwash during loading.	
Marine Impact 5. Spillage of sand and gravel in the loading area and along the conveyor system.	5a. Install a windscreen on the overwater portions of the conveyor.	Reduce wind-blown spillage from the conveyor.	While some spillage would be inevitable, impacts would be limited to areas immediately adjacent to the existing loading area. Compensatory mitigation (see Marine Impact 3) would serve to offset this impact over time.
A movable boom provides more opportunities to spill, due to operator error.	5b. Prohibit the use of a movable boom for loading.	Reduce the likelihood of spillage due to human error.	
Wind would blow some materials into the water.	5c. Equip the discharge end of the conveyor with a "down spout".	Reduce the distance sand and gravel is uncontained and exposed to wind before landing in the barge.	
Filling barges to capacity would result in overspill of materials.	5d. Restrict barge loading to 80% maximum capacity.	Avoid spillage due to overfilling of barges and allows more freeboard to secure load within barge.	
Operators may be unaware of procedures that result in spills, and spills may be detected later, but the cause would remain unknown. Workers may not feel accountable for spills, and thereby may be less diligent in preventing spills.	5e. Establish video monitoring of loading operations to identify spillage or potential spillage.	Allow verification of compliance with and assess efficacy of protective measures.	

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Spills may be undetected.	5f. Conduct quarterly dive surveys to identify spillage during first year and if spillage is found to be limited reassess annually.	Identify and quantify spillage that occurs during loading, and, most importantly, identify need to alter procedures to avoid subsequent spills.	
Workers may sweep spilled materials into the water, since it would be much easier.	5g. Prohibit washing or sweeping of spilled materials from dock into water.	Reduce additional contribution to spillage from "cleaning" activities.	
Workers may spill sand from the spill tray.	5h. Establish a protocol to prevent spillage during cleaning of spill tray.	Reduces additional contribution to spillage from "cleaning" activities.	
Marine Impact 6. Geoduck harvesting conflicts.	6. Establish an access agreement among the Applicant, WDNR, and Puyallup Tribes.	Prevent interference with harvesting of geoducks by the tribes or state licensee.	None. Interference with geoduck harvest would be avoided.
Marine Impact 7. Potential adverse effects on Puget Sound chinook salmon, including startling or otherwise altered behavior of juvenile salmon.	7a. Restore the riparian zone by replanting with native vegetation and stabilizing soils within 300 feet of the shoreline.	Compensate for potential disturbance and habitat loss.	The behavior of individual salmon may be altered due to noise. Eelgrass loss and noise could cause a minor reduction in available salmon foraging habitat at the site. The overall effect, with mitigation, would be minimal. No substantial reduction in salmon survival at the site is likely. Shoreline habitat enhancement would provide long-term benefits.
	7b. Implement design considerations per King County policies and guidelines, as revised in response to the listing of Puget Sound chinook salmon.	Ensure use of best available science in design recommendations for protection of chinook salmon.	

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
Marine Impact 8. Potential adverse impacts on forage fish (herring, surf smelt, and sand lance).	8. Establish additional eelgrass (see Marine Impact 2 above).	Provide substrate for herring spawning and habitat for herring, surf smelt, and sand lance.	Noise may make individual herring not select the site for spawning. The site is not a major spawning area but it is used, at least in some years. Herring or other species that would have spawned at the site would likely spawn in other locations, which could reduce spawning success at those other locations due to inferior conditions and/or competition from other spawning individuals.
Chapter 7 – Noise			
Noise Impact 1. Increased noise perceived by neighbors as annoying or disruptive.	1a. Employ radar-based backup warning systems on all heavy equipment.	Reduce noise, as alarm would sound only upon threat of collision (rather than sounding continuously whenever equipment is moving backward).	People could hear noise from mining equipment and other activities on the site.
	1b. Engage the services of an independent consultant to monitor noise levels produced, reporting such findings to King County to ensure compliance with noise standards.	Detect and remediate violations of noise standard.	
	1c. Establish an advisory committee to monitor and evaluate complaints relating to the project.	Allow onsite operations to be modified appropriately if significant or consistent complaints are observed.	
	1d. Expand site buffer along eastern and western perimeter to reduce noise and increase screening provided by topography.	Reduce noise and visual impacts.	

Table S-2. Continued

Specific Adverse Environmental Impacts	*Possible Mitigation*	*Intended Environmental Benefits*	*Unavoidable Adverse Impacts*
Chapter 8 – Transportation			
Transportation Impact 1. Increased risk of interference or hazard due to unannounced barge departure and arrival.	1. Require normal reporting of arrival/departure activities under the Puget Sound Vessel Traffic Service for all tugs serving the dock.	Reduce risk of interference or hazard that could result in collisions or spills.	None expected.
Chapter 9 – Land and Shoreline Use			
LU Impact 1. Potential conflict with residential uses.	1. Increase vegetated perimeter at selected locations to reduce potential conflicts with or disturbances to adjacent residences.	Reduce adverse impacts on adjacent residential land uses.	Although noise, visual, and access changes would occur, such impacts would be in compliance with existing land use law, especially in light of the current zoning of the site.
Chapter 10 – Environmental Health and Safety			
Health Impact 1. Risk of arsenic leaving the site as dust during soil extraction and containment procedures.	1a. Clear and collect contaminated soils in manageable phases.	Reduce health risks associated with the release of arsenic-contaminated dust into the air.	None.
	1b. Cover contaminated soils while temporarily stockpiling or transporting them to containment cells.	Same as 1a.	
	1c. Place temporary covers over contaminated material within containment cells prior to final sealing of the cell.	Same as 1a.	
Health Impact 2. Arsenic in soils within the containment cells could be mobilized in the event the bottom liner or cover fails.	2a. Use “linear low-density polyethylene” geo-membranes to line and cover containment cells.	Reduce health risks associated with the release of arsenic contamination into the air or water.	None.
	2b. Use additional sand in the cell liner and cover.	Same as 2a.	

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
	2c. Construct a 3-foot or greater berm at the tow of the cell.	Same as 2a.	
	2d. Design cover system to ensure that it does not fail, causing off-site erosion.	Same as 2a.	
	2e. Revise site grading plan to eliminate direct-runoff pathway to Puget Sound at the cell's east end.	Same as 2a.	
Health Impact 3. Placement of the containment cell in the northern edge of the property may result in instability of the sea bluff due to the extra weight along the top of a sensitive slope. Normal erosion and retreat of the top of the slope could undermine the containment cell causing an uncontrolled release of soil with elevated concentrations of metals.	3. Place containment cell to minimize adverse effects based on the final design specifications for the mine. Specify the location and final placement of the cell in the CAP.	Reduce chance of erosion or slope failure due to containment cell placement.	None.
Health Impact 4. Placement of an impermeable liner and cover above and below the containment cell could trap methane gas that would be generated naturally from organic matter in the soil.	4. Create a provision for collecting and venting gases and install a methane-collection system in the containment cell.	Reduce chance of fire or explosion resulting from excessive amounts of trapped methane or other flammable gases.	None.
Chapter 11 – Light, Glare, and Aesthetics			
Visual Impact 1. Change in overall visual character of the site.	1a. Restore forest wherever possible (see Chapter 5 mitigation measures).	Reduce visual impacts associated with project activities.	Increased mining would produce obvious changes in topography and overall visual character of the site.
	1b. To provide a more natural appearance, contour slopes with undulating terracing, rather than traditional linear terracing.	Same as 1a.	

Table S-2. Continued

Specific Adverse Environmental Impacts	***Possible Mitigation***	***Intended Environmental Benefits***	***Unavoidable Adverse Impacts***
	1c. Increase the buffers at the western and eastern corners of the property to increase screening and reduce the visual presence of the operation to the Gold Beach and Sandy Shores Communities.	Same as 1a.	
Chapter 12 – Recreation			
Recreation Impact 1. Reduced opportunities for unauthorized, informal recreation at the site. Potential safety hazards to people entering the site.	1a. Establish secure access points for public use of non-active portions of the site and beach.		
	1b. Work with the County and community to identify potential public uses.	Maintain informal recreational opportunities.	Reduced public access.